# The Sizewell C Project

## 5.8 Freight Management Facility Flood Risk Assessment

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# Executive Summary

This Flood Risk Assessment (FRA) presents an assessment of existing flood risk from all sources of flooding to the proposed freight management facility (FMF) and is submitted as part of the application for development consent for Sizewell C Project. The FRA also describes future flood risk to the site taking account of climate change and considers possible changes in flood risk to off-site receptors as a result of the proposed development. It also presents mechanisms for managing residual risk.

The proposed development is in Flood Zone 1. The site is at low flood risk from fluvial, coastal, groundwater, sewers and reservoirs.

Flood risk from surface water is variable across the site. The large majority of the site is at 'very low' risk of surface water flooding. Two isolated small pockets of land exist at 'low' risk at the north-western edge and middle of the site, and a very small patch of land at 'high' risk of flooding outside the proposed development itself, but along the existing Felixstowe road at the western boundary.

The 'low' and 'high' surface water flood risk locations at the north-western and western edges of the site are along a potential overland surface water flow path. This north-western edge at 'low' risk is proposed as a planting and green area which is not vulnerable to the flood risk. The western extent at 'high' surface water flood risk is on the access road to and from the proposed development. In this location, inspection of Light Detection and Ranging (LiDAR) (Ref. 1.9) data identified that the surface water flow path runs beneath the road by approximately 2 metres (m). Therefore, access to the proposed development would not be affected by surface water flooding from this source and the road is at lower risk than suggested by the surface water flood risk data. The small area in the middle of the site is a small isolated dip in the topography which would be addressed by local landscaping and the drainage strategy.

The proposed development is in Flood Zone 1 and is classed as 'low probability of flooding from river or sea' under the National Planning Policy Framework (NPPF) (Ref. 1.1) guidance for flood risk and coastal change. The proposed development is considered appropriate in terms of flood risk vulnerability and passes the Sequential Test.

The proposed development would use sustainable drainage to manage the potential increase of surface water run-off through the attenuation and controlled discharge of flows to ground and local watercourses. This is addressed as part of the drainage strategy.

The proposed development is considered to be appropriate in terms of flood risk, the proposed mitigation measures and in accordance with NPPF guidance.

# 1. Introduction

## 1.1 Background

1.1.1 This Flood Risk Assessment (FRA) describes the flood risk, from all sources, to the proposed freight management facility (FMF) site (referred to herein as the 'proposed development') and the predicted impact of the proposed development on flood risk in general. This FRA is submitted as part of the application for development consent for 'Sizewell C Project'[1].

1.1.2 The proposed development is one of the Sizewell C Project's Associated Development sites; a temporary FMF, located south-east of Ipswich, to the east of the River Orwell.

1.1.3 This FRA also describes how the risk of flooding would be managed and provides a number of recommendations to minimise any residual impacts associated with the proposed development.

1.1.4 The construction of the Sizewell C Project would generate additional vehicular traffic on the local highway and transport networks due to the movement of building materials and equipment. The FMF would play an important role in reducing the movement of large amounts of building materials, equipment and resources, mitigating adverse transport effects on the environment and local communities.

1.1.5 Once the need for the facility has ceased, with the completion of the construction of the Sizewell C main development site, the FMF would be removed, and the site reinstated to its original agricultural use.

1.1.6 The FMF site is approximately 11 hectares (ha) in size and would accommodate approximately 150 parking spaces for heavy goods vehicles (HGVs).

# 2. Legislation, policy and guidance

## 2.1 Introduction

2.1.1 This section identifies and describes the legislation, policy and guidance of relevance to the FRA for the proposed development.

2.1.2 Legislation and policy have been considered at a national and local level. The following are relevant as they have influenced the scope and/or methodology adopted for the FRA:

[1] SZC Co's proposal to build and operate a new nuclear power station, comprising two UK European Pressurised Reactors™ (EPRs), at Sizewell in Suffolk, north of the existing Sizewell B power station.

- Overarching National Planning Policy Statement (EN-1) (Ref. 1.1);
- ONR/EA Joint Advice Note: Principles for Flood and Coastal Erosion Risk Management (Ref. 1.2);
- National Planning Policy Framework (Ref. 1.3);
- National Planning Policy Guidance (Ref. 1.4);
- Flood Risk Assessments: Climate Change Allowances (Environment Agency) (Ref. 1.5).
- Flood and Water Management Act 2010 (Ref. 1.6).
- Suffolk Coastal Local Plan (Ref. 1.7).
- Suffolk Flood Risk Management Strategy (Ref. 1.8).

## 2.2 Legislation

### a) Flood and Water Management Act 2010

2.2.1 The Flood and Water Management Act was enacted in 2010. It aims to improve both flood risk management and the way we manage our water resources by creating clearer roles and responsibilities. This includes a lead role for upper tier and unitary local authorities in managing local flood risk (from surface water, ground water and ordinary watercourses) and a strategic overview role of all flood risk for the Environment Agency. The Flood and Water Management Act provides opportunities for a more comprehensive, risk-based approach on land use planning and flood risk management by local authorities and other key partners.

## 2.3 National policies and guidance

### a) Overarching National Policy Statement for Energy EN-1

2.3.1 The Overarching National Policy Statement for Energy (EN-1) (Ref. 1.1) was prepared in 2011 and provides specific guidance on the development of energy infrastructure in relation to flood risk for the lifetime of the facilities. The national flood risk policies reflected in this document have since been superseded, however the guiding principles are still applicable and are also embedded in the current national policies (NPPF). EN-1 confirms that an FRA is required to assess flood risk from all sources for the lifetime of the project by competent people. The FRA would, among other aspects, need to identify flood risk reduction and management

measures. Residual risks would also require assessment to consider their acceptability.

2.3.2 In relation to surface water management, EN-1 promotes the appropriate use of sustainable drainage (SuDS) to facilitate the sustainable development of energy developments. The SuDS should aim to prevent an increase in surface water flood risk associated with the increase in discharge from the site.

### b) Joint Office for Nuclear Regulation and Environment Agency Principles for Flood and Coastal Erosion Risk Management Advice Note

2.3.3 The Office for Nuclear Regulation and Environment Agency joint advice note sets out "*the approach to flood risk in the nuclear new-build programme in England*." (Ref. 1.2). The note states that flood hazard analysis should be reported to the Environment Agency via planning submissions in the form of Flood Risk Assessments and to the Office for Nuclear Regulation in nuclear safety cases.

2.3.4 The principle of the flood risk analysis set out in the note is that all flood risk analysis work would be suitable for both the FRA and nuclear safety case(s).

2.3.5 Appendix D of the joint advice note, confirms that for associated development site if the associated infrastructure is not critical to the day to day running of the site, such as a road built to assist with local transport capacity improvements, "*then the most relevant climate change criteria must be applied in accordance with national planning policy*".

### c) National Planning Policy Framework and Guidance

2.3.6 The NPPF (Ref. 1.3) sets out the Government's planning policies for England. The NPPF seeks to ensure that flood risk is considered at all stages of the planning and development process, to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk of flooding. Where there are no reasonably available sites in Flood Zone 1, the Local Planning Authority can consider reasonably available sites in Flood Zone 2. Only when there are no reasonably available sites for development in Flood Zones 1 and 2 should the suitability of sites in Flood Zone 3 be considered.

2.3.7 In addition, the NPPF states that "*the development should be made safe for its lifetime without increasing flood risk elsewhere*." For a development to be considered acceptable with regards to flood risk, the Sequential Test requirements must be satisfied, along with demonstrating the development:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- is appropriately flood resistant and resilient;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

2.3.8 Further details of the requirements for Sequential Testing and sustainable drainage are provided in the following two sections.

### i. Sequential Testing

2.3.9 The National Planning Practice Guidance (PPG) Flood Risk and Coastal Change (Ref. 1.4) supports the NPPF with additional guidance on flood risk vulnerability classifications and managing residual risks. The National PPG provides further description of flood zones (**Table 2.1**), vulnerability classifications (**Table 2.2**) and compatibility matrix (**Table 2.3**) in order to assess the suitability of a specific site for a certain type of development.

**Table 2.1: Summary of flood zone definitions**

| Flood Zone | Probability of Flooding | Return Periods |
|---|---|---|
| 1 | Low | Land having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). |
| 2 | Medium | Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%); or<br>Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%). |
| 3a | High | Land having a 1 in 100 or greater annual probability of river flooding (≥1%); or<br>Land having a 1 in 200 or greater annual probability of sea flooding (≥0.5%). |
| 3b | High – Functional Floodplain | **This zone comprises land where water has to flow or be stored in times of flood.**<br>Local planning authorities should identify in their Strategic Flood Risk Assessments (SFRAs) areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on Flood Maps). |

### Table 2.2: Summary of flood risk vulnerability classifications

| Vulnerability Classification | Description |
|---|---|
| Essential Infrastructure | • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.<br>• Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.<br>• Wind turbines. |
| Highly Vulnerable | • Police and ambulance stations; fire stations and command centers; telecommunications installations required to be operational during flooding.<br>• Emergency dispersal points.<br>• Basement dwellings.<br>• Caravans, mobile homes and park homes intended for permanent residential use.<br>• Installations requiring hazardous substances consent (where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure'). |
| More Vulnerable | • Hospitals.<br>• Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.<br>• Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.<br>• Non–residential uses for health services, nurseries and educational establishments.<br>• Landfill and sites used for waste management facilities for hazardous waste.<br>• Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan. |
| Less Vulnerable | • Police, ambulance and fire stations which are not required to be operational during flooding.<br>• Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.<br>• Land and buildings used for agriculture and forestry.<br>• Waste treatment (except landfill and hazardous waste facilities).<br>• Minerals working and processing (except for sand and gravel working).<br>• Water treatment works which do not need to remain operational during times of flood.<br>• Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place. |
| Water Compatible | • Flood control infrastructure. |

| Vulnerability Classification | Description |
|---|---|
| Development | • Water transmission infrastructure and pumping stations.<br>• Sewage transmission infrastructure and pumping stations.<br>• Sand and gravel working.<br>• Docks, marinas and wharves.<br>• Navigation facilities.<br>• Ministry of Defence defence installations.<br>• Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.<br>• Water-based recreation (excluding sleeping accommodation).<br>• Lifeguard and coastguard stations.<br>• Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.<br>• Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan. |

**Table 2.3: Flood Risk Vulnerability and Flood Zone 'Compatibility'**

| Flood Risk Vulnerability Classification (see table d2) | | Essential Infrastructure | Water Compatible | Highly Vulnerable | More Vulnerable | Less Vulnerable |
|---|---|---|---|---|---|---|
| Flood Zone | Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Zone 2 | ✓ | ✓ | Exception Test required | ✓ | ✓ |
| | Zone 3 | Exception Test required | ✓ | × | Exception Test required | ✓ |
| | Zone 3b 'Functional Floodplain' | Exception Test required | ✓ | × | × | × |
| Key:<br>✓ Development is appropriate × Development should not be permitted | | | | | | |

2.3.10 Following application of the Sequential Test, if it is not possible (consistent with wider sustainability objectives) for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied, if appropriate. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared; and

- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

2.3.11 Where the Exception Test is required, both elements of the Exception Test would have to be passed for development to be allocated or permitted. Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development.

### ii. Sustainable drainage and surface water

> *The National PPG on Flood Risk and Coastal Change (Ref. 1.4) supports the NPPF with additional guidance on flood risk, which states that "developers should seek opportunities to reduce the overall level of flood risk in the area and beyond. This can be achieved, for instance, through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems, through safeguarding land for flood risk management, or where appropriate, through designing off-site works required to protect and support development in ways that benefit the area more generally."*

2.3.12 In order to manage surface water on the site, it is necessary to consider the appropriateness of various sustainable drainage system (SuDS) measures, using the SuDS hierarchy set out in the National PPG Guidance (Ref. 1.4).

2.3.13 The aim should be to discharge surface run off as high up the drainage options hierarchy as reasonably practicable. These are listed with the most favourable option first and least preferable last:

> *"1. into the ground (infiltration);*
>
> *2. to a surface water body;*
>
> *3. to a surface water sewer, highway drain, or another drainage system;*
>
> *4. to a combined sewer." (Paragraph 80,* ***Error! Reference source not found.****).*

2.3.14 The National PPG acknowledges that some types of SuDS may not be practicable in all locations. Locations may be constrained in areas of flood risk.

2.3.15 The Environment Agency classifies surface water flood risk (Ref. 1.9) into four categories; 'very low', 'low', 'medium' and 'high' (**Table 2.4**).

**Table 2.4: Summary of flood risk from surface water definition**

| Probability of Surface Water Flooding | Return Periods |
|---|---|
| Very low | Land with less than 1 in 1,000 annual probability of surface water flooding (<0.1%). |
| Low | Land with between 1 in 1,000 and 1 in 100 annual probability of surface water flooding (0.1% - 1%). |
| Medium | Land with between 1 in 100 and 1 in 30 annual probability of surface water flooding (1% - 3.3%). |
| High | Land with greater than 1 in 30 annual probability of surface water flooding (>3.3%). |

#### d) Flood Risk Assessments: Climate Change Allowances

2.3.16 The Environment Agency's online advice note 'Flood Risk Assessments: Climate Change Allowances' was published in February 2016 and amended in April 2016, February 2017 and February 2019.

2.3.17 This advice note provides guidance for determining appropriate climate change allowances for fluvial, tidal and peak rainfall intensities. The climate change allowances consider the geographical location, life span of the proposed development, flood risk, vulnerability classification associated with the type of development and critical drainage areas. The guidance on peak rainfall intensity allowances is outlined in **Table 2.5**.

**Table 2.5: Peak rainfall intensity allowance in small and urban catchments (1961-90 baseline) (Source: Table 2, Environment Agency Climate Change Allowances)**

| | Total potential change anticipated for 2010-2039 | Total potential change anticipated for 2040-2059 | Total potential change anticipated for 2060-2115 |
|---|---|---|---|
| Upper End | 10% | 20% | 40% |
| Central | 5% | 10% | 20% |

## 2.4 Local plans

### a) Suffolk Coastal Local Plan

#### i. Final Draft Proposed Local Plan

2.4.1 On 1 April 2019, East Suffolk Council (ESC) was created, merging the former districts of Suffolk Coastal District Council (SCDC) and Waveney District Council.

2.4.2 The ESC is in the process of replacing the former SCDC Local Plan. The final draft of the new local plan was published, and a six-week period set for the receipt of representations in relation to legal compliance and soundness between 14 January 2019 and 25 February 2019. The SCDC have stated that the adoption of the plan is scheduled for Spring 2020.

### ii. Existing Local Plan

2.4.3 The existing SCDC Local Plan (Ref. 1.7) sets out how the area should be developed. It incorporates core strategy and development management policies and saved policies. This document forms part of the formal development plan and is used in the determination of planning applications.

2.4.4 The existing SCDC Local Plan was updated in July 2018 and includes a number of saved policies. Previously saved policies have been superseded or abandoned whilst others have remained. None of the remaining saved policies are considered relevant for the proposed development.

2.4.5 Three strategic policies and one development management policy have been identified as relevant for the proposed development, as outlined within **Table 2.6**. No reference to the allocation of the site has been found in the SCDC Local Plan.

**Table 2.6: Relevant Suffolk Coastal Local Plan policies**

| Policy Number | Policy Name | Summary |
|---|---|---|
| SP10 | A14 & A12 | The Council supports the provision of improvements to the A12. |
| SP12 | Climate Change | The District Council will contribute towards the mitigation of the effects of new development on climate change by minimising the risk of flooding and ensuring appropriate management of land within floodplains. |
| SP13 | Nuclear Energy | The local issues that need to be adequately addressed consist of at least the following:<br>Transport issues such as the routing of vehicles during construction, improvements to the road system (including the A12), and use of rail and sea for access all having regard to such factors as residential amenity. |
| DM28 | Flood Risk | Proposals for new development, or the intensification of existing development, will not be permitted in areas at high risk from flooding, i.e. Flood Zones 2 and 3, unless the applicant has satisfied the safety requirements in NPPF (and any successor). |

### b) Suffolk Flood Risk Management Strategy

2.4.6 Suffolk County Council is responsible for coordinating a partnership approach to flood and coastal risk management with all risk management authorities in Suffolk. They do this through the Suffolk Flood Risk

Management Partnership who produced the Local Flood Risk Management Strategy (Ref. 1.8) in March 2016.

2.4.7 The objective of the strategy is "to take a pragmatic approach to reduce the current flood risk and ensure that we do nothing to make this worse in the future." This objective is in accordance with the principles laid out in the NPPF.

2.4.8 Seven objectives of the Local Flood Risk Management Strategy have been identified, two of which are of relevance to the proposed development:

- objective 3: To prevent an increase in flood risk as a result of development by preventing additional water entering existing drainage systems wherever possible; and
- objective 4: Take a sustainable and holistic approach to flood and coastal management, seeking to deliver wider economic, environmental and social benefits, climate change mitigation and improvements under the Water Framework Directive.

# 3. Development description and scope of this assessment

## 3.1 The existing site

3.1.1 The FMF is approximately 11ha in size and is located to the south-east of the A12/A14 junction near Ipswich, with local roads along its western (A1156) and southern (Felixstowe Road) boundaries. The site is approximately 32 kilometres (km) to the south-west of the main development site.

3.1.2 The site is accessed off Felixstowe Road to the south. Seven Hills Crematorium is located further to the west of the site and an intervening area of land is identified for high quality business and professional services development (offices) in the first draft Suffolk Coastal Local Plan.

3.1.3 The Suffolk Coasts and Heaths Area of Outstanding Natural Beauty is located approximately 670m to the south-west of the site at its closest point. The site comprises arable land (Agricultural Land Classification Grades 1 3a and 3b), and the ecological value of the land is low. There are no ecologically designated sites within 1km of the site.

## 3.2 The proposed site masterplan and design

3.2.1 The site masterplan in **Figure 2.1**, **Volume 8**, **Chapter 2** of the **Environmental Statement (ES)** (Doc Ref. 6.8) shows an indicative

arrangement for the site to fulfil its objectives as a freight management facility.

3.2.2 The current layout includes: parking spaces for approximately 150 HGVs in the centre of the site, additional car parking spaces to the north, an access road with freight control barriers and cabins to the west and 3m high landscape bunds to the west and east.

3.2.3 A swale would be constructed along the northern boundary and part of the eastern boundary of the site to ensure that on-site surface water run-off is contained within the site. The western section of this swale would be lined to stop infiltration and the remainder would be unlined to allow infiltration into the underlying strata. These measures would also ensure that off-site run-off that would otherwise enter the site is captured. Further swales are proposed along the southern side of Felixstowe Road and either side of the site entrance.

3.2.4 Geo-cellular storage structures would be installed beneath two of the landscape bunds to attenuate water and regulate water flows within the site.

3.2.5 Water falling onto impermeable surfaces (for example the access roads and areas used by HGVs) would pass through a Class 1 Bypass Separator which would remove pollutants prior to discharge into the SuDS infrastructure.

3.2.6 Foul sewage from the amenity and welfare buildings would be treated on-site. Effluent would pass through a package treatment plant prior to being discharged into the SuDS infrastructure.

## 3.3 Topography

3.3.1 **Figure 1** provides remotely sensed LiDAR data (Ref. 1.11) to show the topography of the site. This shows the highest elevation on site is approximately 29m above ordnance datum (AoD), located midway along the southern boundary.

3.3.2 Elevation remains largely consistent across the site, with small undulations associated with current agricultural usage. A slight slope from west to east of up to 5-7m was identified. The lowest on-site elevation of approximately 22.5m AoD was noted on the north-west boundary.

## 3.4 Geology and hydrogeology

3.4.1 The British Geological Survey (BGS) maps (Ref. 1.12) show the site to be located in an area with a bedrock geology of the Crag Group, formed of sand. This type of geology presents variable permeability.

3.4.2 The BGS map records superficial geology for the site as part of the Kesgrave Catchment Subgroup - Sand and Gravel. Superficial Deposits formed up to 3 million years ago in the Quaternary Period and the local environment was previously dominated by rivers.

3.4.3 The Aquifer Designation Map (Ref. 1.13) indicates the bedrock geology of the area is classified as a 'Principal' aquifer. Principal aquifers are defined by the Environment Agency as: *"geology that exhibit high permeability and/or provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale"*.

3.4.4 The Aquifer Designation Map classifies the superficial geology as a Secondary A aquifer. Secondary A aquifers are defined as permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

3.4.5 The Groundwater Vulnerability Map (Ref. 1.14) indicates the site to be located in an area defined as a Minor Aquifer with high vulnerability. Groundwater vulnerability classification is a product of soil type and the underlying geology; however, the depth to groundwater is not considered. The Groundwater Vulnerability map is intended to indicate: *"the vulnerability of groundwater to a pollutant discharged at ground level based on the hydrological, geological, hydrogeological and soil properties (Ref. 1.23)*

## 3.5 Hydrology

3.5.1 The site falls entirely within the Gipping operational catchment (Ref. 1.15).

3.5.2 Environment Agency 'Main Rivers' are usually larger rivers and streams which the Environment Agency maintain and improve. The Environment Agency also has the powers to improve and construct work on Main Rivers to manage flood risk. **Figure 2** identifies all 'Main Rivers' that are near to the site boundary.

3.5.3 There are no Environment Agency Main Rivers within 1km of the site. The closest Main River is the River Orwell (Shotley Point to Orwell Bridge), which flows east to west approximately 2.3km south of the site.

3.5.4 Ordinary watercourses are the remaining watercourses that are not classified as Main River. Lead local flood authorities, local authorities and internal drainage boards have powers to carry out flood risk management work on ordinary watercourses. **Figure 3** shows all identified watercourses and ponds that are in proximity to or within the site boundary.

3.5.5 Review of ordnance survey mapping has identified two linear waterbodies some 30m and 120m in length immediately north of the site boundary.

3.5.6 One ordinary watercourse was identified approximately 750m south of the site, a pond was also identified 450m south-west of the site.

3.5.7 Two surface water and one groundwater abstraction points are located to the south of the site, according to the Environment Agency's East Anglia Water Resources Licence Trading map (Ref. 1.16).

3.5.8 The site does not fall within a source protection zone, with the closest zone approximately 5km to the north-west (Ref. 1.17).

# 4. Flood risk appraisal

## 4.1 Historical flooding

4.1.1 The ESC SFRA historic flood record maps provide location points for recorded historic flood events from fluvial, tidal, sewer, groundwater, highway drainage and surface water sources (Ref. 1.18). These maps do not identify any historic flooding to have occurred at the FMF. Absence of record does not necessarily confirm that no flooding has occurred.

## 4.2 Tidal / coastal flood risk

4.2.1 The Flood Map for Planning (Ref. 1.19) shows the site is located in Flood Zone 1 (**Figure 2**). Flood Zone 1 is defined by the Environment Agency as *"land having less than 1 in 1,000 annual probability of river or sea flooding."*

4.2.2 The risk of flooding from tidal or coastal sources is therefore considered to be low.

## 4.3 Fluvial flood risk

4.3.1 The Flood Map for Planning shows the site is located in Flood Zone 1 (**Figure 2**). Flood Zone 1 is defined by the Environment Agency as *"land having less than 1 in 1,000 annual probability of river or sea flooding."*

4.3.2 The risk of flooding from fluvial sources is therefore considered to be low.

## 4.4 Surface water (pluvial) flood risk

4.4.1 **Figure 3** provides the Environment Agency 'Long Term Flood Risk Map' dataset (Ref. 1.9), which highlights risk of surface water flooding to the FMF.

4.4.2 The figure indicates the majority of the site is at 'very low' risk of surface water flooding.

4.4.3 There are two areas of 'low' risk, the first is an isolated area towards the centre of the site, most likely associated with a topographic low point.

4.4.4 The second area of 'low' risk is a possible surface water flow route, thought to be associated with the two ponds north of the site boundary. This overland flow route follows the topography (**Figure 1**), running across the north-west boundary of the site in a south-westerly direction, before entering the ordinary watercourse that drains into the River Orwell south of Levington.

4.4.5 The overland flow route which runs across the north-west boundary above, also crosses the western extent of the site boundary on Felixstowe Road, where an area of 'high' surface water flood risk is identified. However, review of the LiDAR data for this area shows that the road is located at approximately 23.5m AoD, whereas the surface water flow route follows lower topography, appearing to culvert beneath the road at 21.5m AoD at that location. This 2m elevation difference suggests that the road is therefore at a lower risk than portrayed by the surface water flood risk dataset. Therefore, the site is assessed as being at 'low' risk of surface water flooding.

## 4.5 Groundwater flood risk

4.5.1 According to the Geology of Britain viewer (Ref. 1.21) and the SFRA, the main soil types in the area are significantly permeable. Permeable soils have the potential to present groundwater flooding problems in areas with high water table.

4.5.2 The BGS susceptibility to groundwater flooding map in the SFRA (Ref. 1.10) identifies there is limited potential for groundwater flooding to occur.

4.5.3 The SFRA indicates that "there is no consistent local information available which provides evidence of possible future groundwater flood risk in Suffolk" (Ref. 1.20). The SFRA has no records of any groundwater incident in the area.

4.5.4 It is therefore concluded that the risk of groundwater flooding to the site is low.

## 4.6 Sewer flood risk

4.6.1 The site is currently an undeveloped greenfield site with an agricultural use. There is therefore no existing risk of internal flooding from sewer sources on site. No sewer records have been received for this site.

4.6.2 The Suffolk Coastal and Waveney District Councils Level 1 SFRA does not identify any flooding to have occurred on site from foul or surface water

sewers. The SFRA also does not identify any flooding from highway drainage to have occurred on site or the surrounding highway network.

4.6.3 The risk of sewer flooding to the site is considered to be low.

## 4.7 Flood risk from reservoirs and other artificial sources

4.7.1 Flooding from reservoirs is defined as an uncontrolled release of water from registered reservoirs, i.e. greater than 25,000m$^3$.

4.7.2 The Flood Risk from Reservoirs map (Ref. 1.20) shows the site is not at risk of reservoir flooding. Therefore the site is considered to be at low risk of reservoir flooding.

## 4.8 Summary of potential flood mechanisms

4.8.1 **Table 4.1** includes a summary of flood risk to the FMF.

**Table 4.1: Summary of flood risk to the development site**

| Source of Flooding | Flood Risk | Description |
|---|---|---|
| Tidal | Low | Less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%). |
| Fluvial | Low | Less than 1 in 1,000 annual probability of river or sea flooding in any year (<0.1%). |
| Surface water (pluvial) | Majority of the site: very low | Less than 1 in 1,000 annual probability of surface water flooding in any year (<0.1%). |
| | Isolated pockets: low | Between 1 in 1,000 and 1 in 100 annual probability of surface water flooding (0.1% - 1%). One isolated pocket of low risk and area of low risk associated with potential flow path across northern boundary. |
| Groundwater | Low | Soil is permeable, but the site is located in higher ground levels than surrounding areas. |
| Sewers | Low | Low risk due to current agricultural use. |
| Reservoirs and other artificial sources | Low | Not at risk of flooding from reservoirs or other artificial sources. |

# 5. Flood risk management

## 5.1 The Sequential Test – application of flood risk vulnerability and flood zone compatibility

5.1.1 The proposed development would only be required for the duration of construction of the Sizewell C main development site and as such, would be in operation for 9–12 years (**Volume 8**, **Chapter 2** of the **ES)**.

5.1.2 In terms of flood risk and vulnerability, the proposed development is classified as 'less vulnerable' in accordance with the definitions given in **Table 2.2**. The site is located wholly in Flood Zone 1 (defined in **Table 2.1**).

5.1.3 Given this, the proposed development is considered to be appropriate for this flood zone in accordance with the flood risk vulnerability and flood zone compatibility table (**Table 2.3**) and, therefore, passes the Sequential Test.

## 5.2 Climate change

5.2.1 The Flood Map for Surface Water shown on the Environment Agency's Long Term Flood Risk Map (Ref. 1.9) do not take account of the possible impacts of climate change and consequent changes in the future probability of surface water flooding.

5.2.2 Given the potential sources of flooding outlined in **section 4** of this chapter, the actual flood risk posed to the site is derived from surface water. Therefore, the climate change allowance to be applied relates to an increase in the intensity of rainfall events likely to affect surface water.

5.2.3 The NPPF requires that the proposed development remains safe through the development's lifetime. The site is not within a critical drainage area. In accordance with the guidance, allowances for climate change have been considered within the development of the site drainage strategy, to account for the range of impact both on and off site for the 2010 – 2039 epoch.

## 5.3 On-site flood risk

5.3.1 As set out above, the site is entirely located in Flood Zone 1 and at low risk of fluvial, coastal, groundwater, sewers and reservoirs flooding.

5.3.2 The current high-level proposed site layout used to inform this FRA demonstrates that almost all parking areas and ancillary buildings have been located outside the area at risk of flooding from surface water. There is one small area of low surface water flooding risk in the centre of the HGV parking area. This is associated with a topographic low spot and would be mitigated through landscaping and the HGV parking drainage system.

5.3.3 The surface water flow route that crosses the site at the north-west boundary intersects the end of the proposed swale. The swale in this area of surface water flooding risk would be sized appropriately, as part of the drainage design, to ensure sufficient capacity for surface water drainage attenuation and the existing surface water flood volumes to be managed.

## 5.4 Off-site flood risk

5.4.1 The existing site is currently 'greenfield', with no impermeable surfaces and small localised areas of surface water flood risk. Therefore, the proposed development would significantly increase the impermeable area on the site. Without attenuation, this increase in impermeable area would increase the surface water run-off and the associated flood risk both on and off site.

5.4.2 The current layout of the proposed development provides appropriate on-site drainage, incorporating SuDS measures, ensuring that surface water run-off does not increase flood risk elsewhere. Further details are provided in the site drainage strategy (Ref. 1.10) and Outline Drainage Strategy at Appendix 2A, Volume 2 of the Environmental Statement (**Book 6**).

5.4.3 Once the operation of the FMF has ceased, the site would be returned to its original agricultural use. The removal of the development would include the removal of any related drainage and SuDS measures, which would have no adverse impact on flood risk to the site.

## 5.5 Applicability of Sustainable Drainage Systems

5.5.1 In accordance with National PPG for Flood Risk and Coastal Change (Ref. 1.4), the sustainable drainage hierarchy has been applied to the proposed development and comments on the suitability of options are provided in **Table 5.1**.

**Table 5.1: Application of sustainable drainage hierarchy**

| OPTION | COMMENT | VIABILITY |
|---|---|---|
| Into the ground infiltration. | An initial review of geological conditions on site indicates that infiltration may be possible as a form of surface water disposal. However further infiltration testing would be required to determine suitability of ground conditions. It is possible that other drainage discharge options could be required. | Potential |
| To a surface water body. | There are no main rivers within 1km of the site. There is a surface water flow route that crosses the north-east of the site which runs south, meeting the River Orwell. | Some potential |
| To a surface water sewer, highway drain, or another drainage system. | There does not appear to be any existing highways drainage on Felixstowe Road. | No potential |
| To a combined sewer. | Sewer records have not been obtained at present. To discharge to a combined sewer is the lowest on the SuDS hierarchy and other, more suitable opportunities are to be pursued prior to investigating combined sewers. | No potential |

5.5.2 The ground conditions have infiltration drainage potential. To ascertain ground infiltration rates, infiltration testing has been arranged to Building

Research Establishment Digest 365 (Ref.1.24), to inform the detailed design of the site.

## 5.6 Water management and drainage

5.6.1 The drainage strategy for the site (Ref. 1.10) and Outline Drainage Strategy at Appendix 2A, Volume 2 of the Environmental Statement (**Book 6**) provides information about the proposed surface water management and drainage for this development, including the design approach, use of SuDS and consideration of climate change.

5.6.2 The proposed development would include sustainable drainage for the lifetime of the site to manage any additional surface water run-off from it.

5.6.3 Infiltration, in combination with swales for exceedance events are proposed for the discharge of surface water runoff.

5.6.4 A swale is proposed along the northern boundary and part of the eastern boundary of the site to ensure that on-site surface water run-off is contained within the site. The western section of this swale would be lined to stop infiltration and remainder would be unlined to allow infiltration into the underlying strata. During construction, a perimeter ditch would be constructed to capture any off-site run-off. These measures would also ensure that off-site run-off that would otherwise enter the site is captured.

5.6.5 Geo-cellular storage structures would be installed beneath two of the landscape bunds to attenuate water and regulate water flows within the site.

5.6.6 Due to the size of the parking area, Class 1 Bypass Separators would remove pollutants prior to discharge into the SuDS infrastructure, providing a second level of treatment to the surface water runoff.

5.6.7 Climate change would be taken into account in the detailed drainage design through the application of the appropriate rainfall intensity allowances.

5.6.8 Foul sewage from the amenity and welfare buildings would be treated on-site. Effluent would pass through a package treatment plant prior to being discharged into the SuDS infrastructure.

5.6.9 Monitoring and maintenance of the drainage system would be carried out to preserve its integrity and maintain its design capacity for the lifetime of the proposed development.

## 5.7 Access

5.7.1 The site would be accessed directly off Felixstowe Road. A barrier control system would be located at the access road into the FMF to control the flow of traffic.

5.7.2 There is an area of 'high' surface water flood risk across Felixstowe Road at the western extend of the site. However, the road is situated 2m above the surface water flow route and therefore is not at risk of surface water flooding for access and egress. Furthermore, review of the Environment Agency Long Term Flood Risk map identifies that access and egress can be retained to the east of the FMF.

5.7.3 Due to the low risk of flooding along the access roads within the site and on the access route to the site, safe dry access and egress would be available for the proposed development.

# 6. Residual risk

6.1.1 In any development there is always a potential for there to be a residual flood risk to people and property due to:

- the failure of systems and defences;
- more extreme events than those defined in the NPPF; or
- uncertainties associated with modelled water levels.

6.1.2 Residual risk may remain after flood risk management or mitigation measures have been installed. Therefore, an FRA should consider the residual flood risk and the need for any further measures to ensure the residual risk is managed appropriately.

6.1.3 Climate change is a potential residual risk for the site. The flood zones shown on the Environment Agency's flood map for planning do not take account of the possible impacts of climate change and consequent changes in the future probability of fluvial flooding. This also applies to the flood extents of the flood map for surface water.

6.1.4 A flood risk emergency plan would be in place for the construction and operation of the bypass. The flood risk emergency plan would be developed in accordance with NPPF and Environment Agency guidance and would include procedures to ensure people on-site are safe in the event of a flood.

6.1.5 Monitoring of the weather would be in place to monitor storm conditions. This would probably involve the registration of appropriate staff to the Environment Agency flood warnings and Met Office weather warnings to manage the potential impacts of flooding. This could lead to, if necessary, the halting of construction.

6.1.6 SuDS and existing land drainage structures require regular maintenance to ensure continuing operation to design performance standards. Poor maintenance could result in increased risk of flooding from surface water. The SuDS features would require regular maintenance to prevent blockage.

6.1.7 Maintenance plans or schedules would be developed during the detailed design phase for use during the operational phase. Typical maintenance of dry swales includes mowing and occasional sediment removal, unless additional sediment trap measures are put in place.

# 7. Summary and conclusions

7.1.1 This report has considered all sources of flood risk and identified the mitigation measures included in the site layout.

7.1.2 **Table 4.1** shows flood risk from tidal, fluvial, groundwater, sewers and reservoirs are low.

7.1.3 Flood risk from surface water is variable across the site. The large majority of the site is at 'very low' risk of surface water flooding. Two isolated small pockets of land exist at 'low' risk at the north-western edge and middle of the site, and a very small patch of land at 'high' risk of flooding outside the proposed facility itself, but along the existing Felixstowe Road at the western edge of the site.

7.1.4 The 'low' and 'high' surface water flood risk locations at the north-western and western edges of the site are along a potential overland surface water flow path. This north-western edge at 'low' risk is proposed as a planting and green area which is not vulnerable to the flood risk. The western extent at 'high' surface water flood risk is on the access road to and from the proposed park and ride facility. In this location, inspection of LiDAR data identified that the surface water flow path runs beneath the road by approximately 2m. Therefore, access to the proposed development would not be affected by surface water flooding from this source and the road is at lower risk than suggested by the surface water flood risk data. The small area in the middle of the site is a small isolated dip in the topography which would be addressed by local landscaping and the drainage strategy.

7.1.5 As a result of locating the development in Flood Zone 1, it is considered that there would be no loss in functional floodplain storage or displacement of sea or river flood water as a result of the proposed development.

7.1.6 The proposed development is classed as being 'low vulnerability' under the NPPF and is located in Flood Zone 1. As per the Flood Risk Vulnerability and Flood Zone Compatibility table, the development is considered appropriate in terms of flood risk vulnerability. It therefore passes the Sequential Test.

7.1.7 The increase in impermeable area associated with the proposed development is addressed by the sustainable drainage systems proposed in the drainage strategy, thereby controlling discharge of flows to the surrounding environment.

7.1.8 Based on the information presented, the proposed mitigation measures and in line with NPPF guidance, the development site is considered to be appropriate in terms of flood risk.

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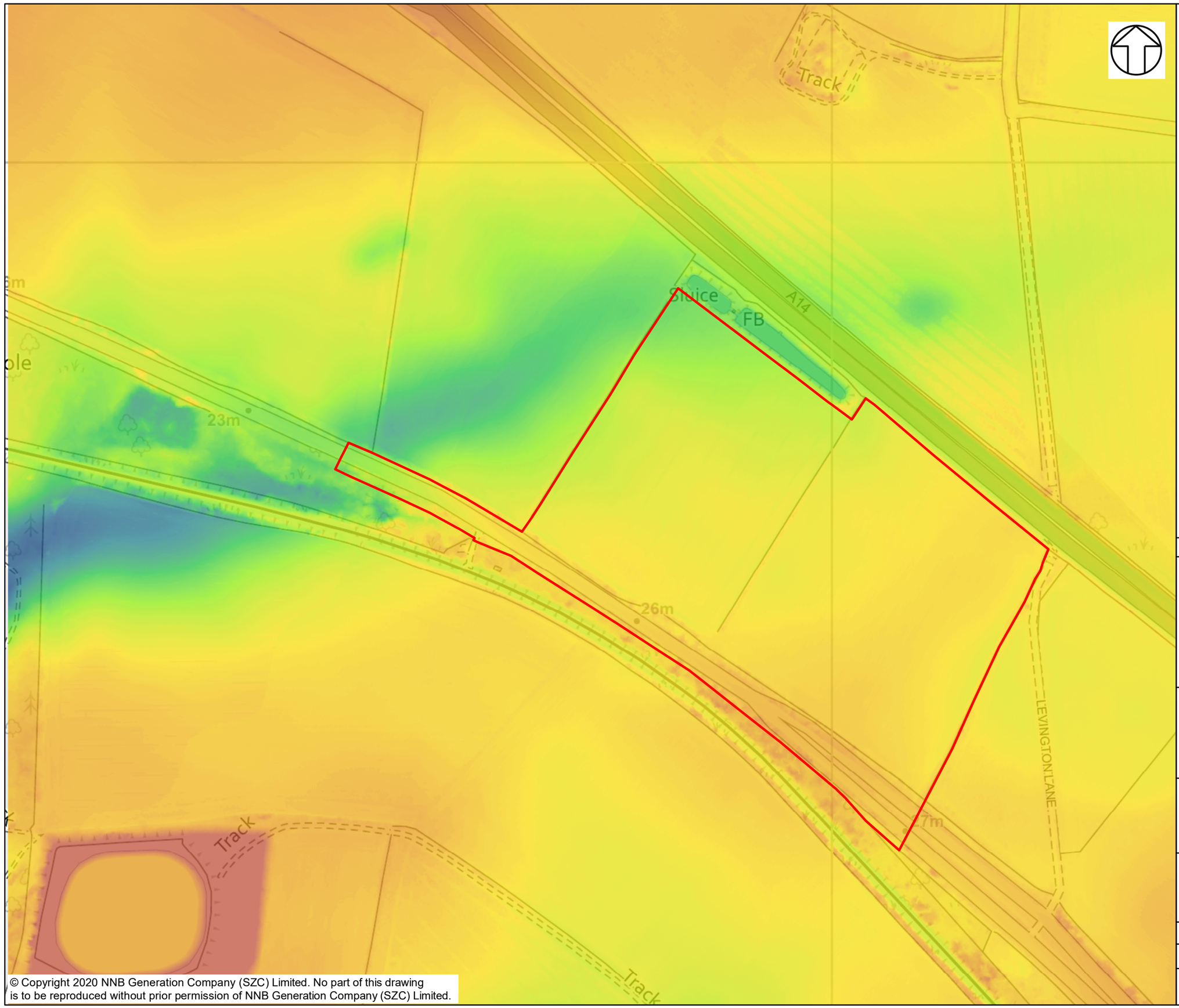


NOTES

KEY

FREIGHT MANAGEMENT FACILITY DEVELOPMENT SITE BOUNDARY

**DIGITAL TERRAIN MODEL (DTM)**

**ELEVATION (M)**

High : 30
28
26
24
22
20
Low : 18

NOT PROTECTIVELY MARKED



DOCUMENT:
SIZEWELL C
FREIGHT MANAGEMENT FACILITY
FLOOD RISK ASSESSMENT

DRAWING TITLE:
TOPOGRAPHIC MAP

DRAWING NO:
FIGURE 1

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DRAWN: P.S
SCALE : 1:3,000 @A3

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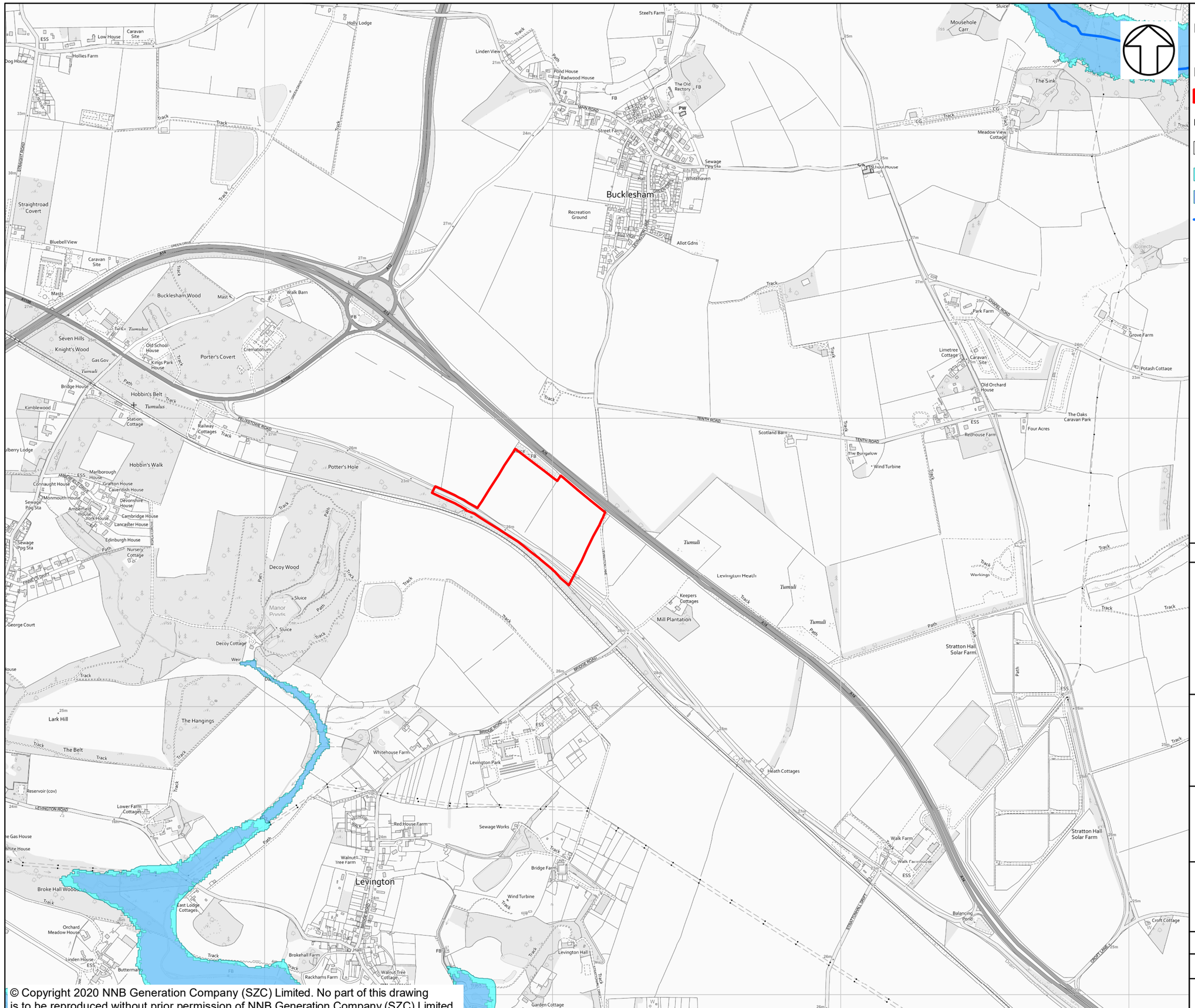


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NOTES

KEY

FREIGHT MANAGEMENT FACILITY DEVELOPMENT SITE BOUNDARY

**ENVIRONMENT AGENCY DATA**

FLOOD ZONE 1

FLOOD ZONE 2

FLOOD ZONE 3

ENVIRONMENT AGENCY MAIN RIVER

NOT PROTECTIVELY MARKED



DOCUMENT:
SIZEWELL C
FREIGHT MANAGEMENT FACILITY
FLOOD RISK ASSESSMENT

DRAWING TITLE:
ENVIRONMENT AGENCY
FLOOD ZONE MAP

DRAWING NO:
FIGURE 2

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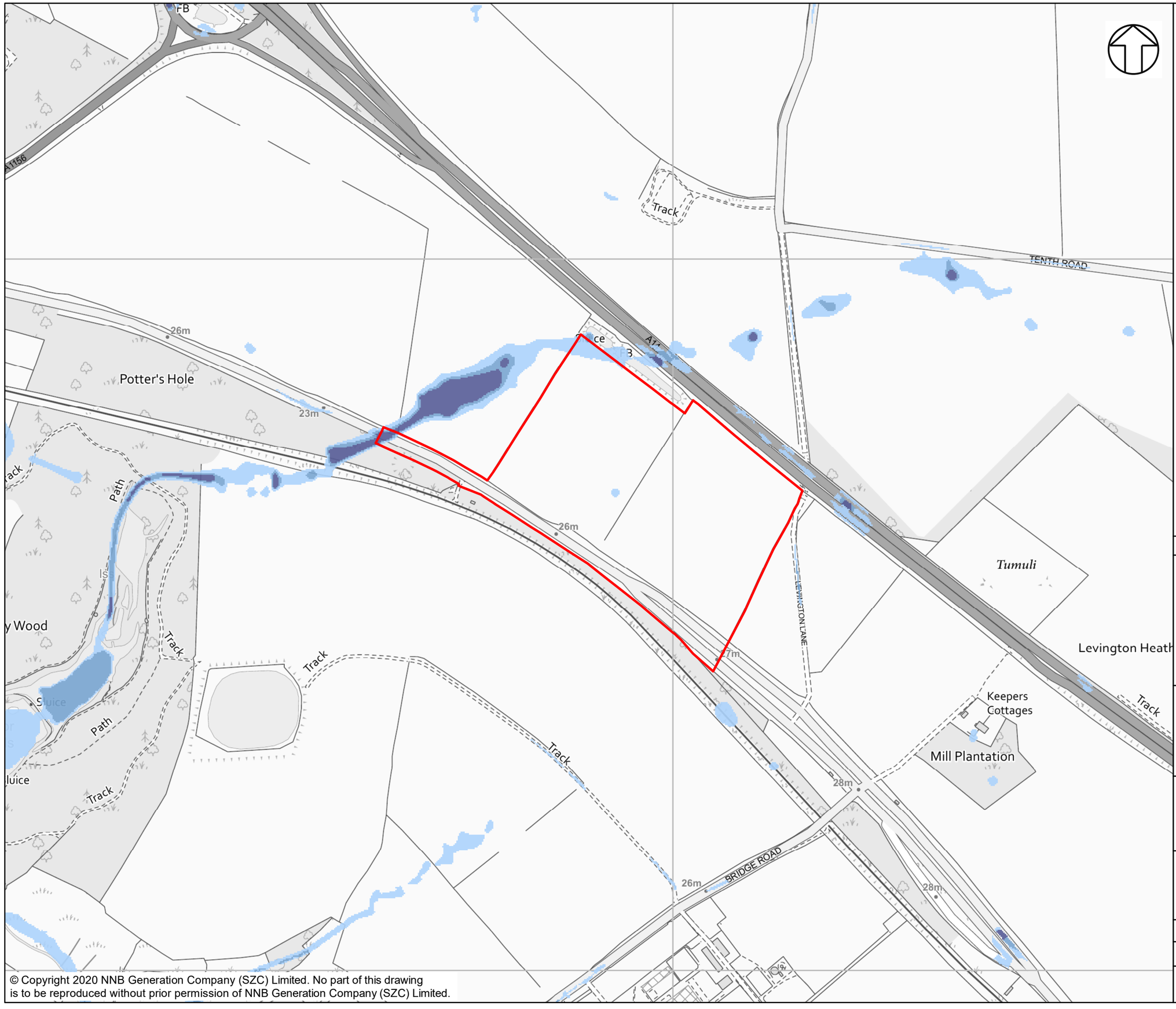


NOTES

KEY

FREIGHT MANAGEMENT FACILITY DEVELOPMENT SITE BOUNDARY

**ENVIRONMENT AGENCY RISK OF SURFACE WATER FLOODING**

HIGH RISK (GREATER THAN 1 IN 30 ANNUAL PROBABILITY OF FLOODING)

MEDIUM RISK (BETWEEN 1 IN 100 AND 1 IN 30 ANNUAL PROBABILITY OF FLOODING)

LOW RISK (BETWEEN 1 IN 1,000 AND 1 IN 100 ANNUAL PROBABILITY OF FLOODING)

VERY LOW RISK (LESS THAN 1 IN 1,000 ANNUAL PROBABILITY OF FLOODING)

NOT PROTECTIVELY MARKED



DOCUMENT:
SIZEWELL C
FREIGHT MANAGEMENT FACILITY
FLOOD RISK ASSESSMENT

DRAWING TITLE:
ENVIRONMENT AGENCY
RISK OF SURFACE WATER FLOODING MAP

DRAWING NO:
FIGURE 3

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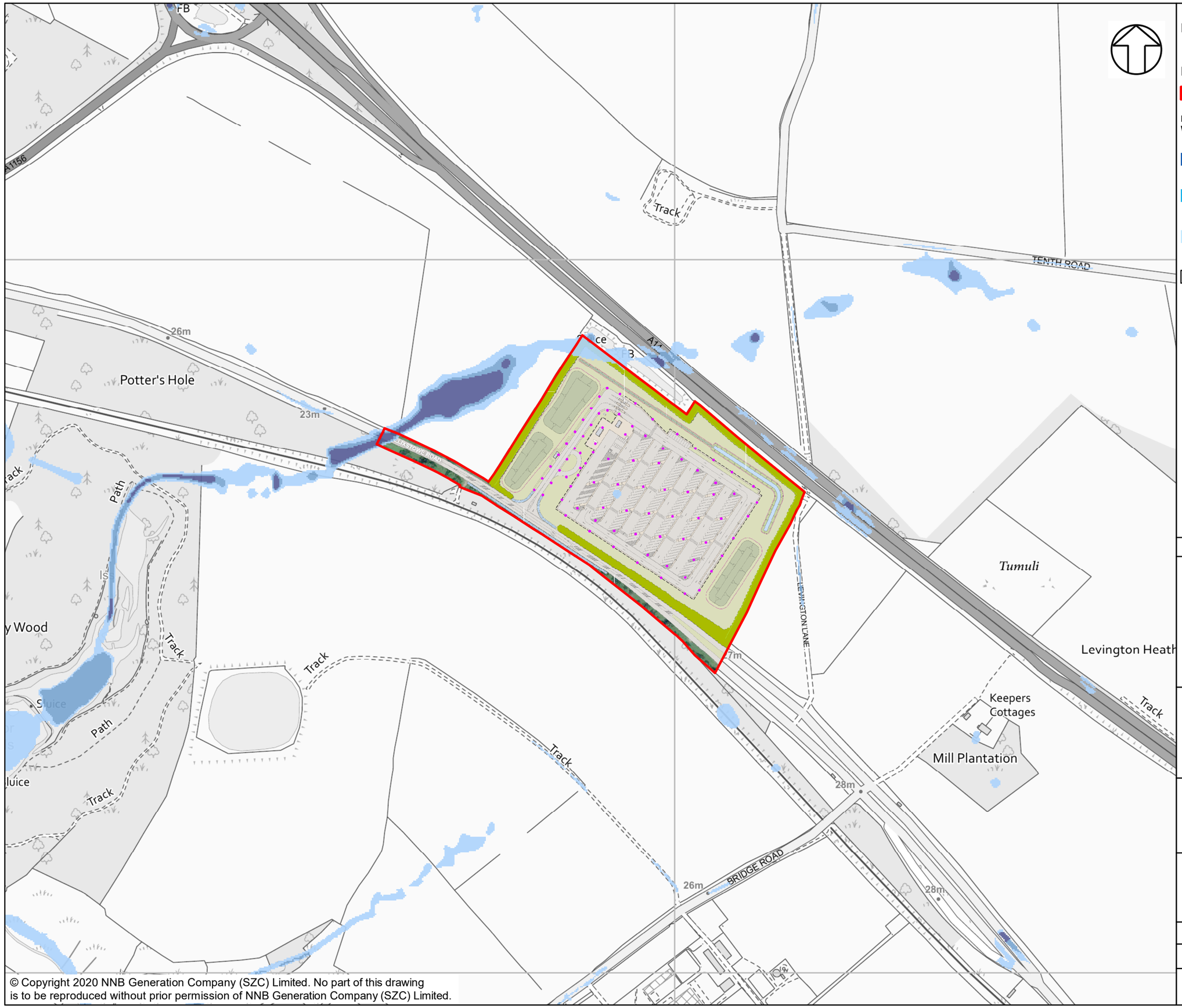


NOTES

KEY

FREIGHT MANAGEMENT FACILITY DEVELOPMENT SITE BOUNDARY

**ENVIRONMENT AGENCY RISK OF SURFACE WATER FLOODING**

HIGH RISK (GREATER THAN 1 IN 30 ANNUAL PROBABILITY OF FLOODING)

MEDIUM RISK (BETWEEN 1 IN 100 AND 1 IN 30 ANNUAL PROBABILITY OF FLOODING)

LOW RISK (BETWEEN 1 IN 1,000 AND 1 IN 100 ANNUAL PROBABILITY OF FLOODING)

VERY LOW RISK (LESS THAN 1 IN 1,000 ANNUAL PROBABILITY OF FLOODING)

NOT PROTECTIVELY MARKED



DOCUMENT:
SIZEWELL C
FREIGHT MANAGEMENT FACILITY
FLOOD RISK ASSESSMENT

DRAWING TITLE:
ENVIRONMENT AGENCY
RISK OF SURFACE WATER FLOODING MAP
WITH SITE LAYOUT

DRAWING NO:
FIGURE 4

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